

REMARKS**Present Status of the Application**

Claims 1-17, 21 and 22 remain pending of which claims 1-17, 21 and 22 stand rejected under 35 U.S.C. § 103(a) as purportedly being unpatentable over Farkas et al. (US 6,001,730, Farkas hereinafter) and Penniman (US 5,373,229, Penniman hereinafter).

The Applicants have most respectfully considered the remarks set forth in this Office Action. Regarding the obviousness rejections, it is however strongly believed that the cited references are deficient to adequately teach the claimed features as recited in the presently pending claims.

Response to 35 U.S.C. 103 (a) rejection

Claims 1-17 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable Farkas et al. (U.S. 6,001,730, Farkas hereinafter) and Penniman (U.S. 5,373,229).

The PTO has the burden under section 103 to establish a prima facie case of obviousness. The PTO satisfy this burden "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988). Moreover, the PTO "must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of claimed invention, would select elements from the cited prior art reference for combination in the manner claimed." *In re Rouffet* 149 F.3d 1350, 1357 (Fed. Cir. 1998). For at least the foregoing reasons, Applicant

respectfully submits the prior art are legally deficient for the purpose of rendering claims 1 and 11 unpatentable.

Applicant respectfully submits that Farkas and Penniman, either alone or in combination, fail to explicitly teach or implicitly suggest "performing a second chemical mechanical polishing process with a second slurry and an oxidant to remove the barrier layer, wherein the oxidant oxidizes the metal layer to adjust a zeta potential of the metal layer during the removal of the barrier layer."

Farkas instead teaches a first CMP process conducted with a slurry that contains an oxidizing agent to remove the metal layer and a second CMP process conducted with a slurry that contains silica abrasive and an ethylenediamine additive to remove the barrier layer. The PTO insists that the second CMP process of Farkas teaches the claimed invention in col. 7, lines 47-50; col. 7, lines 65-66 and col. 8, lines 1-10, lines 22-25. The PTO further insists that a deionized water based slurry containing charged ionic species (ethylenediamine and other solids partially disassociated in water to form charged ionic species) of Farkas, and therefore concludes that zeta potential is created and is inherent that the zeta potential of the metal surface is adjusted. Applicant respectfully disagrees. Although the second slurry of Farkas may contain ionic species, the presence of ionic species does not necessarily mean they are oxidants of metal. In an oxidation/reduction reaction, a compound that oxidizes a metal is simultaneously reduced by the metal. In other words, if a compound is not reducible, it cannot be an oxidant of a metal. Using ethylenediamine as an example as suggested by the PTO, the N-atom in an amine (R_NNH_{3-N}) has an oxidation number of -3, which is the lowest oxidation number that a nitrogen atom can have (a nitrogen atom has four shell orbitals (2s, 2p_x, 2p_y and 2p_z) and can accommodate only eight

valent electrons around it. Since a free nitrogen atom already has five valent electrons, the lowest oxidation number of an N-atom is -3. Therefore, an amine cannot be reduced anymore, and it cannot be an oxidant of a metal. Applicant thus respectfully requests the PTO an affidavit under 37 C.F.R. section 1.104(d)(2) that details the PTO's basis of which components in the second slurry disclosed in Farkas and how these components function as an oxidant of metal.

The PTO's assertion that the change of the zeta potential of metal is presumed to be inherent is also in question. To establish the burden of proof of rejections based on inherency, "the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristics necessarily flows from the teaching of the prior art." *In Ex parte Levy*, 17 USPQ2d 1461, 1464. Further, as stated in *re Spormann*, 363 F.2d 444, 150 USPQ 449, AT 452, "the inherency of an advantage and its obviousness are entirely different questions. That which may be inherent is not necessary known. Obviousness cannot be predicated on what is unknown." Not only no where in Farkas that teaches changing the zeta potential of metal or changing the zeta potential due to an oxidant oxidizing the metal, this is no implication nor suggestion in Farkas that changing the zeta potential of the surface of the metal prevents the carbon-rich particles generated from the low K dielectric layer underneath the barrier layer from adhering onto the surface of the metal layer while the barrier layer is removed. This feature of changing the zeta potential of the surface of the metal prevents the carbon-rich particles from adhering onto the surface of the metal layer is an unknown, and is thus not obvious.

For oxidizing a metal, Farkas specifically teaches using certain oxidants. However, the use of oxidants in Farkas is during the first CMP process to provide an incremental removal of

the copper layer. There is no mentioning of any use of oxidants in the second CMP process of Farkas. Applicant thus disagrees with the PTO's contention in the Response to Arguments. The disclosure in col. 8, ln 22 -25 of Farkas, as noted by the PTO, that the oxidation agent can be any chemical that oxidized copper is directed to the oxidant used in the first CMP process for removing the metal layer, which can not be an equivalent of what is being taught in the instant case that the oxidation of metal is conducted in the second CMP process during the removal of the barrier layer. Therefore, Applicant believes that the PTO is arguing out of hindsight, finding pieces of the present invention within the prior art and assembling them according to the teaching of the present invention. Applicant further notes that it is inappropriate hindsight to look back through Applicants' disclosure and declare claim limitations obvious where such declaration can only be guided by Applicant's disclosure.

no because it does not anticipate

In view of the foregoing, Applicants contend that prior art cited by Examiner neither alone nor in combination teaches every element of claims 1 and 11. Applicants therefore respectfully request the withdrawal of the rejection under 35 U.S.C. 103(a) of claims 1 and 11, and claims 2-10, 21 and 12-17, 22-23, depending therefrom, respectively.

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CONCLUSION

For at least the foregoing reasons, it is believed that all pending claims 1-17, 21-23 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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